# The renewable revolution

Presentation to WHEB

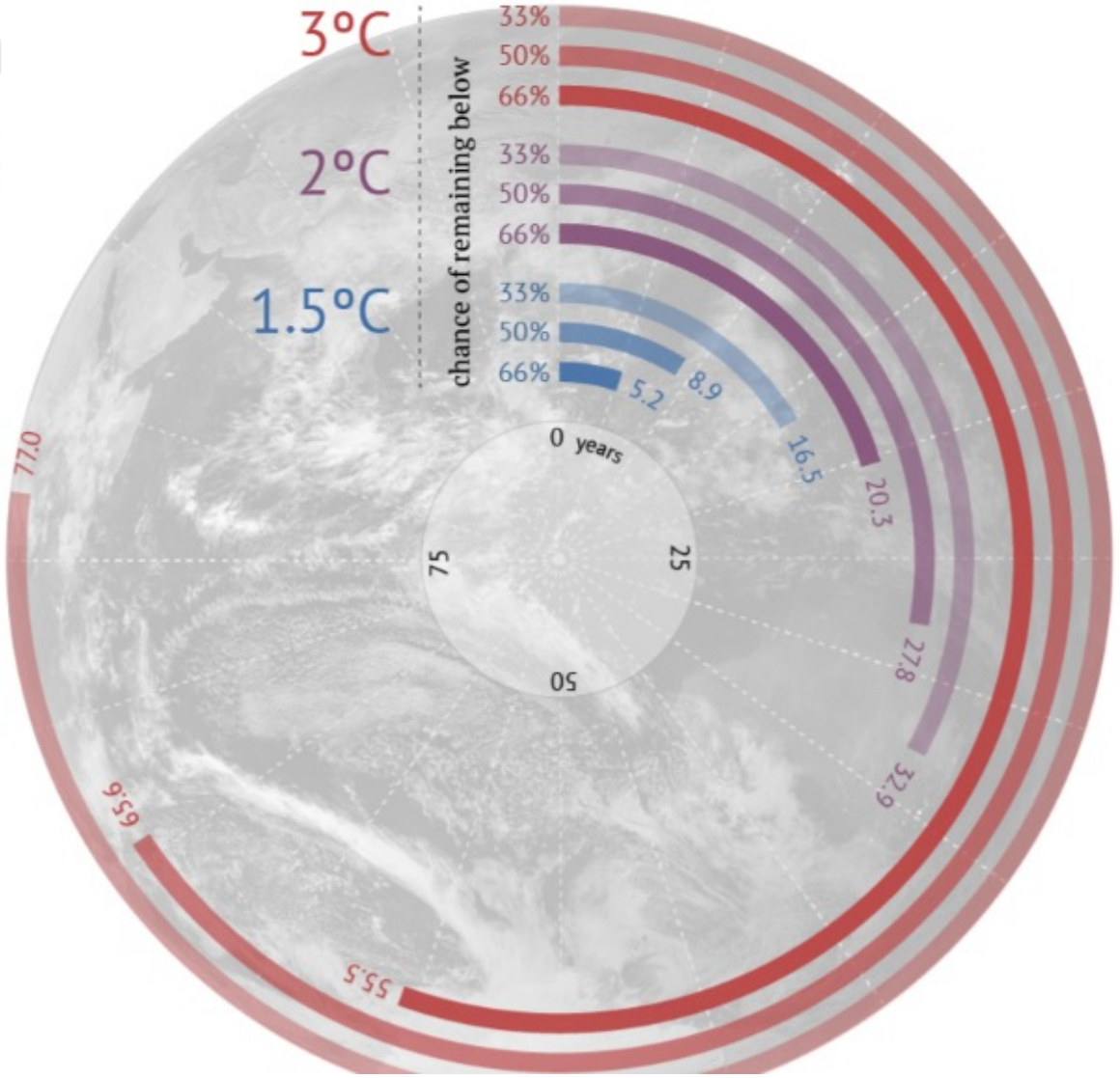
**Kingsmill Bond, CFA**

November 2023

# Fossil fuels have reached the limits of growth

## Carbon Countdown

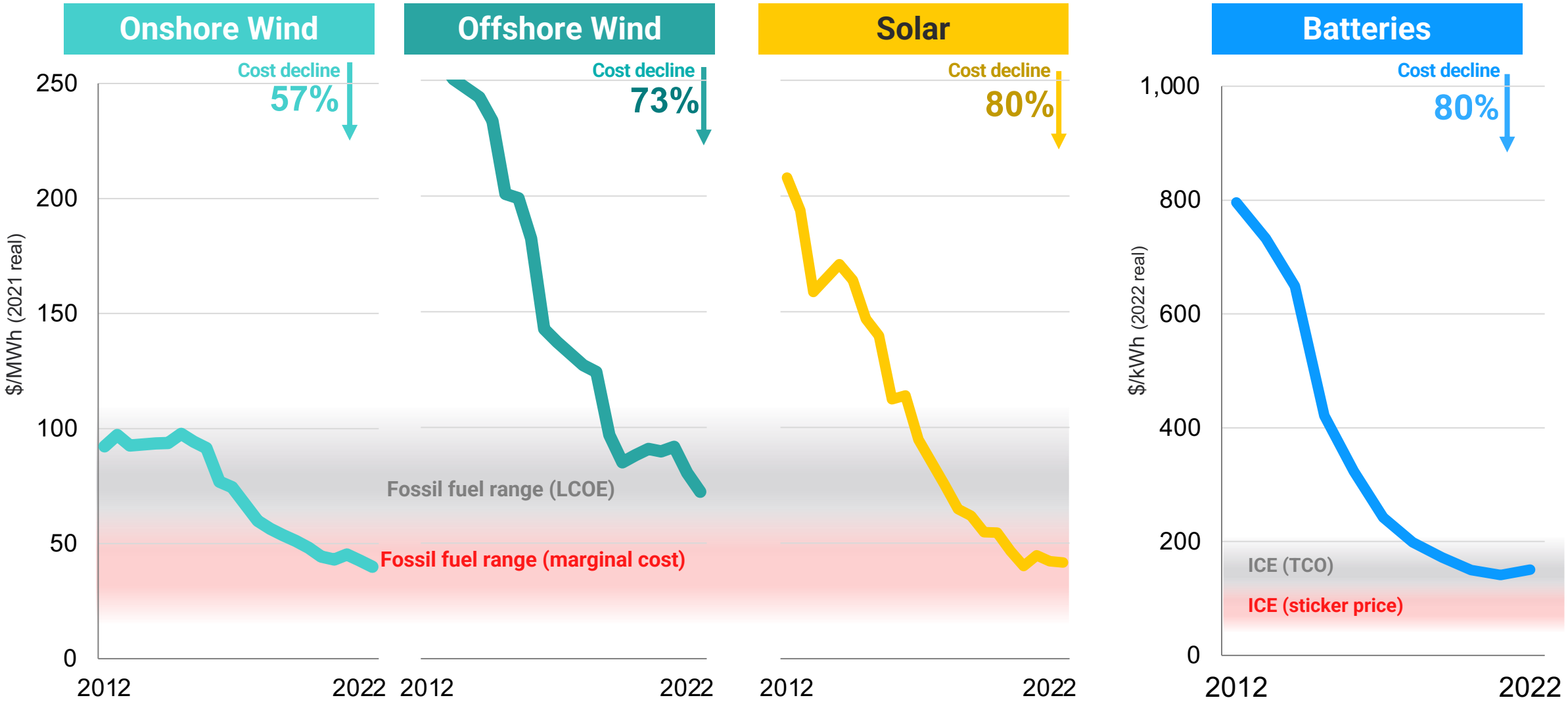
How many years of current emissions would use up the IPCC's carbon budgets for different levels of warming?




CarbonBrief
CLEAR ON CLIMATE

Source: Carbon Brief

# Renewable technologies on learning curves

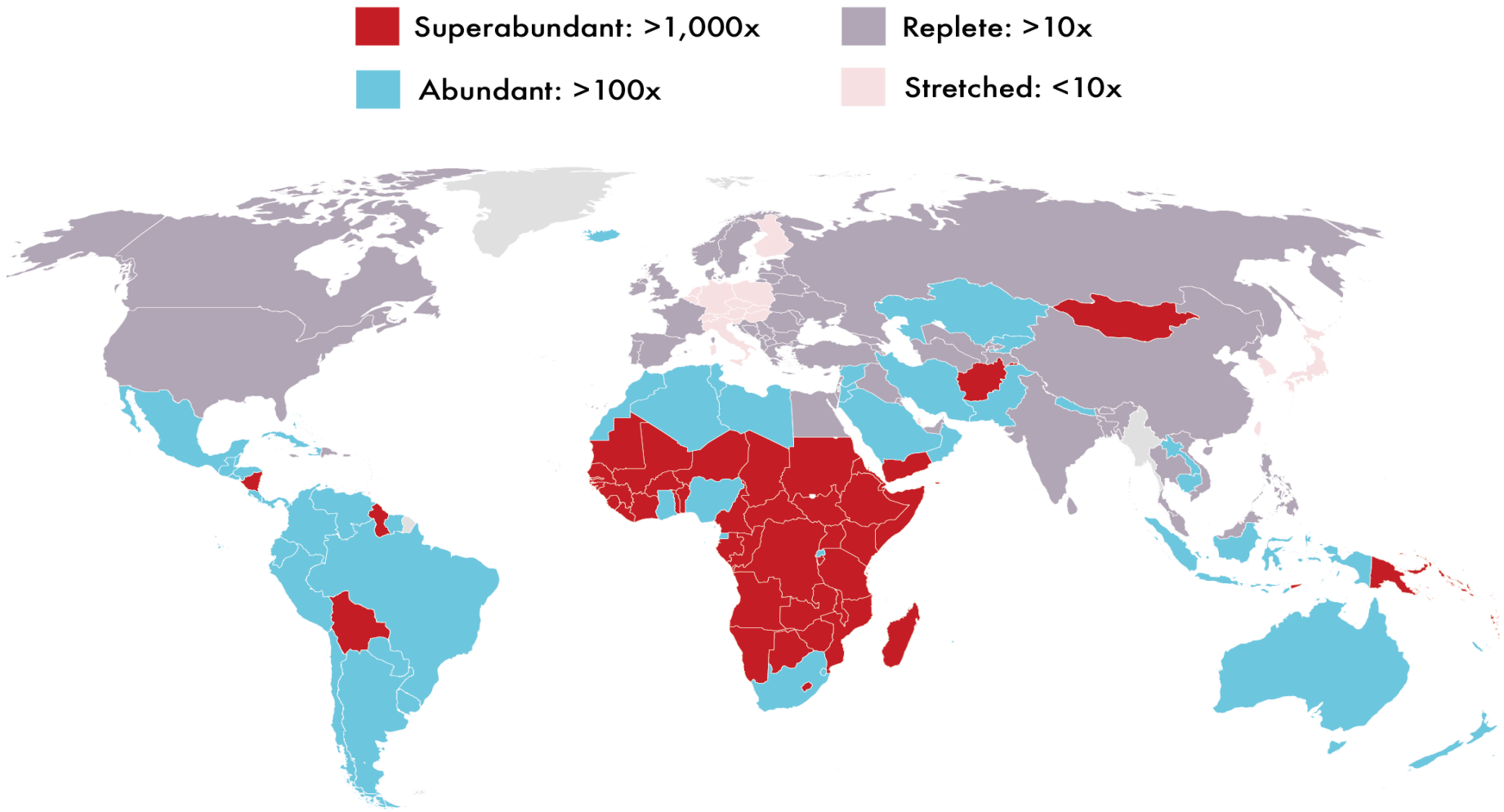





Source: BNEF

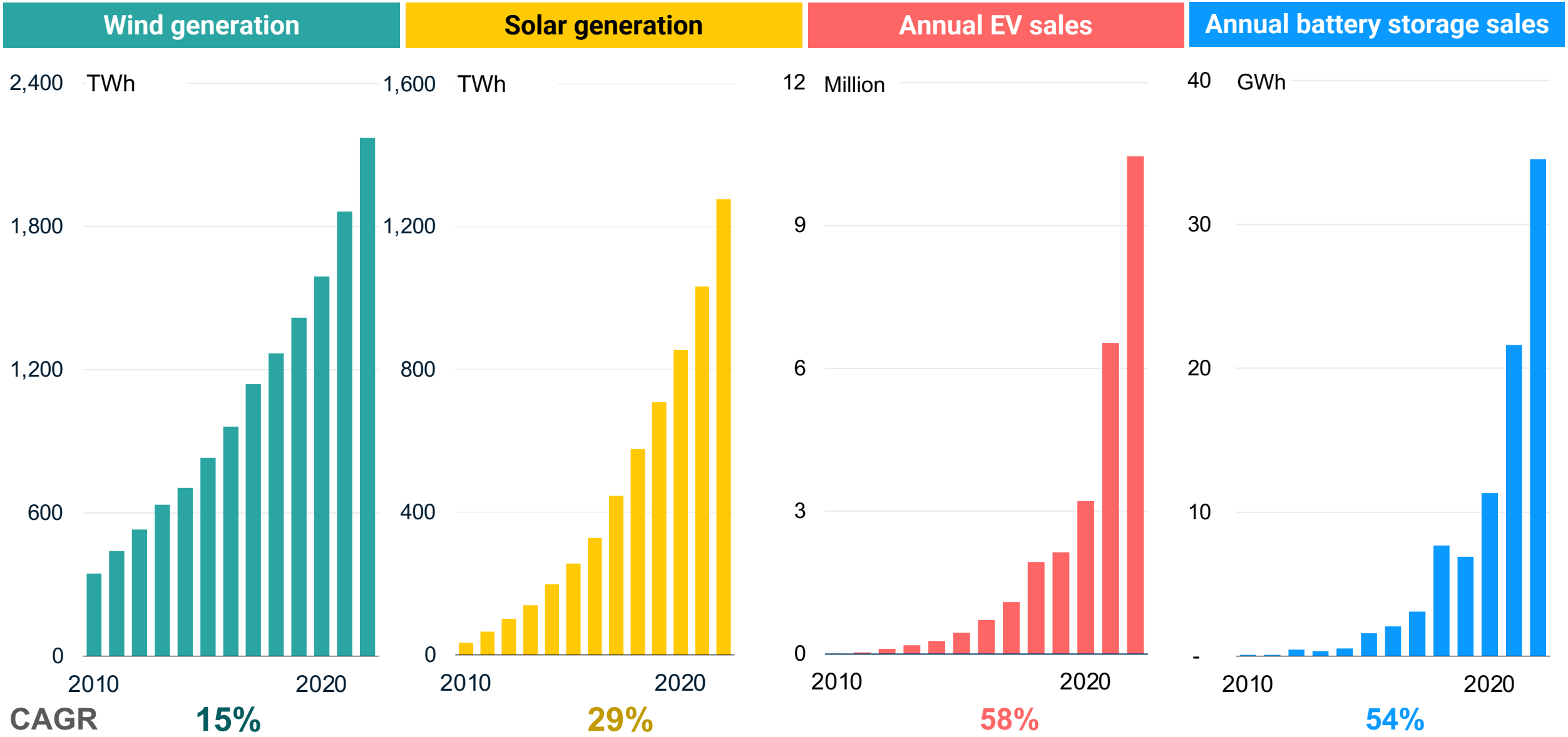
# Have unlocked a huge resource

## Solar and wind potential as share of total energy demand




**Source:** Carbon Tracker

# They are growing exponentially

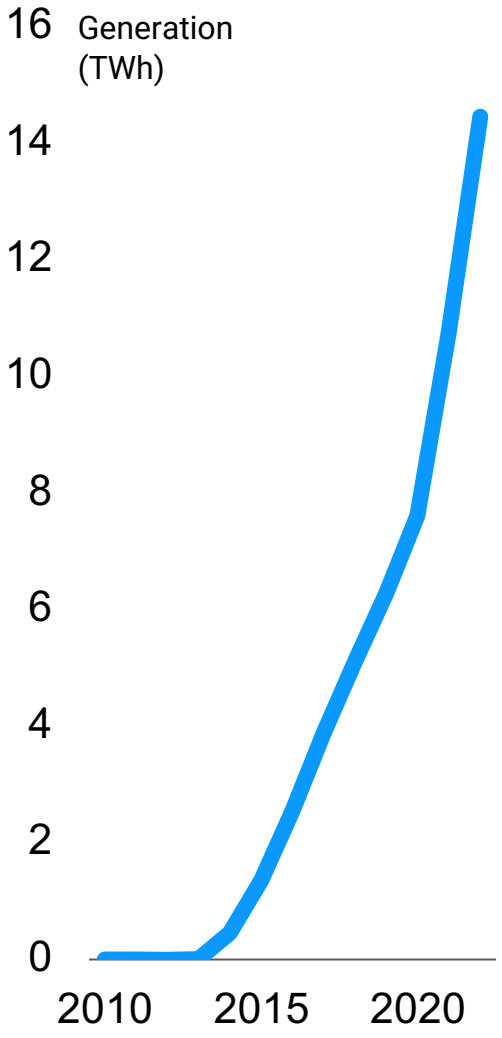




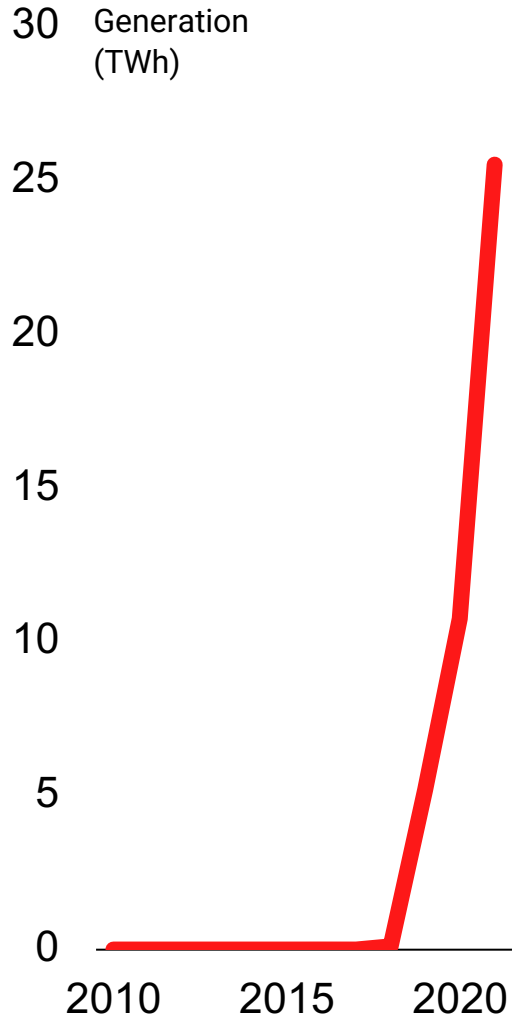

**Source:** BNEF, BP, Ember; Note: CAGR is the compound annual growth rate between 2012 and 2022. All data is global

# And across the world

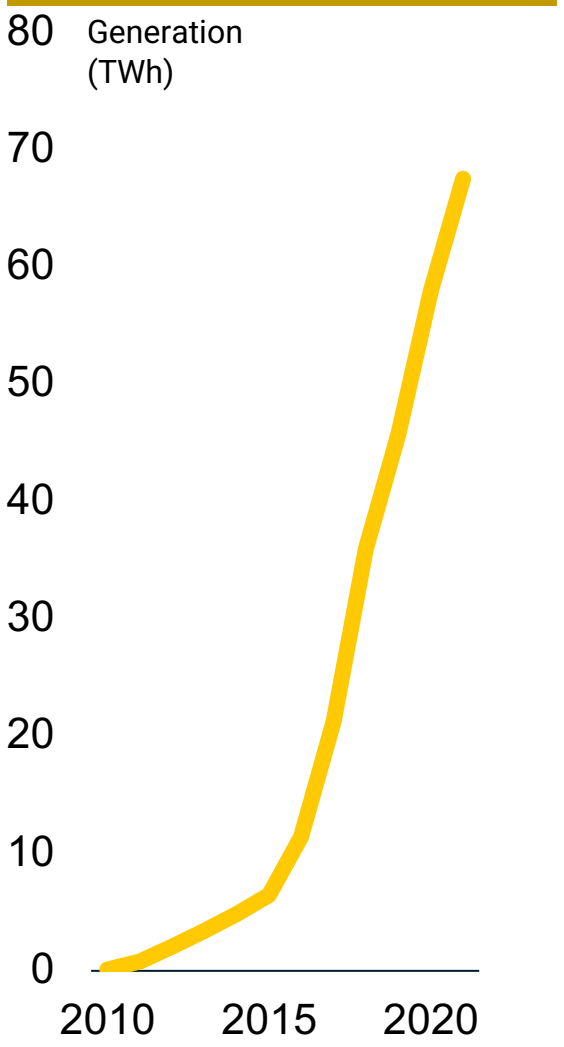
## Chile Solar



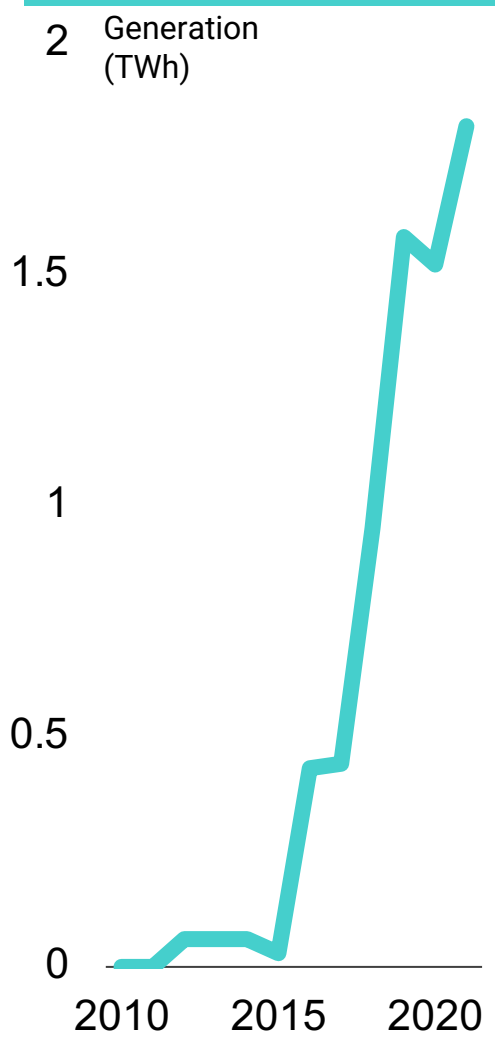

## Vietnam solar




## India solar



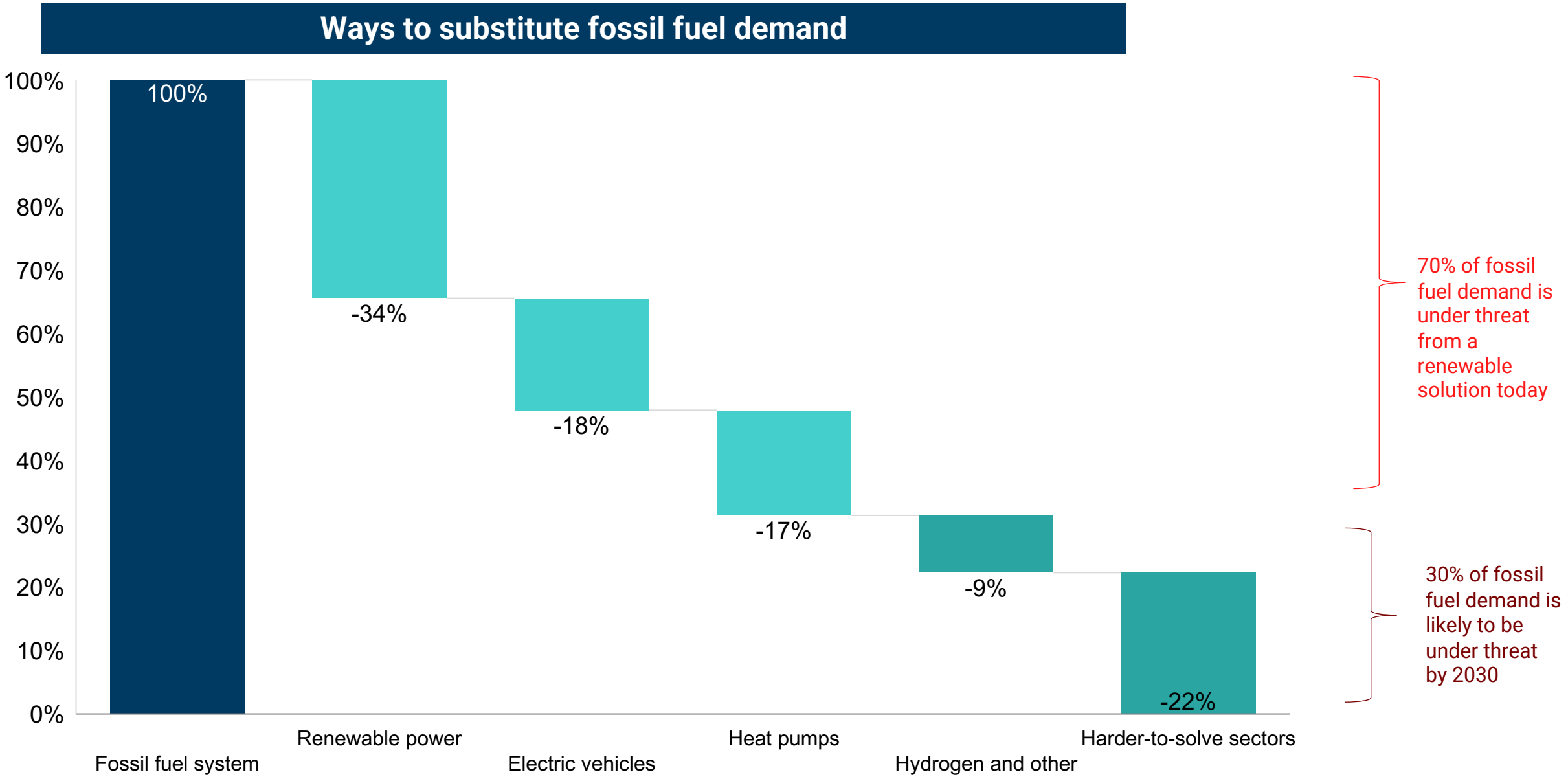

## Morocco Solar





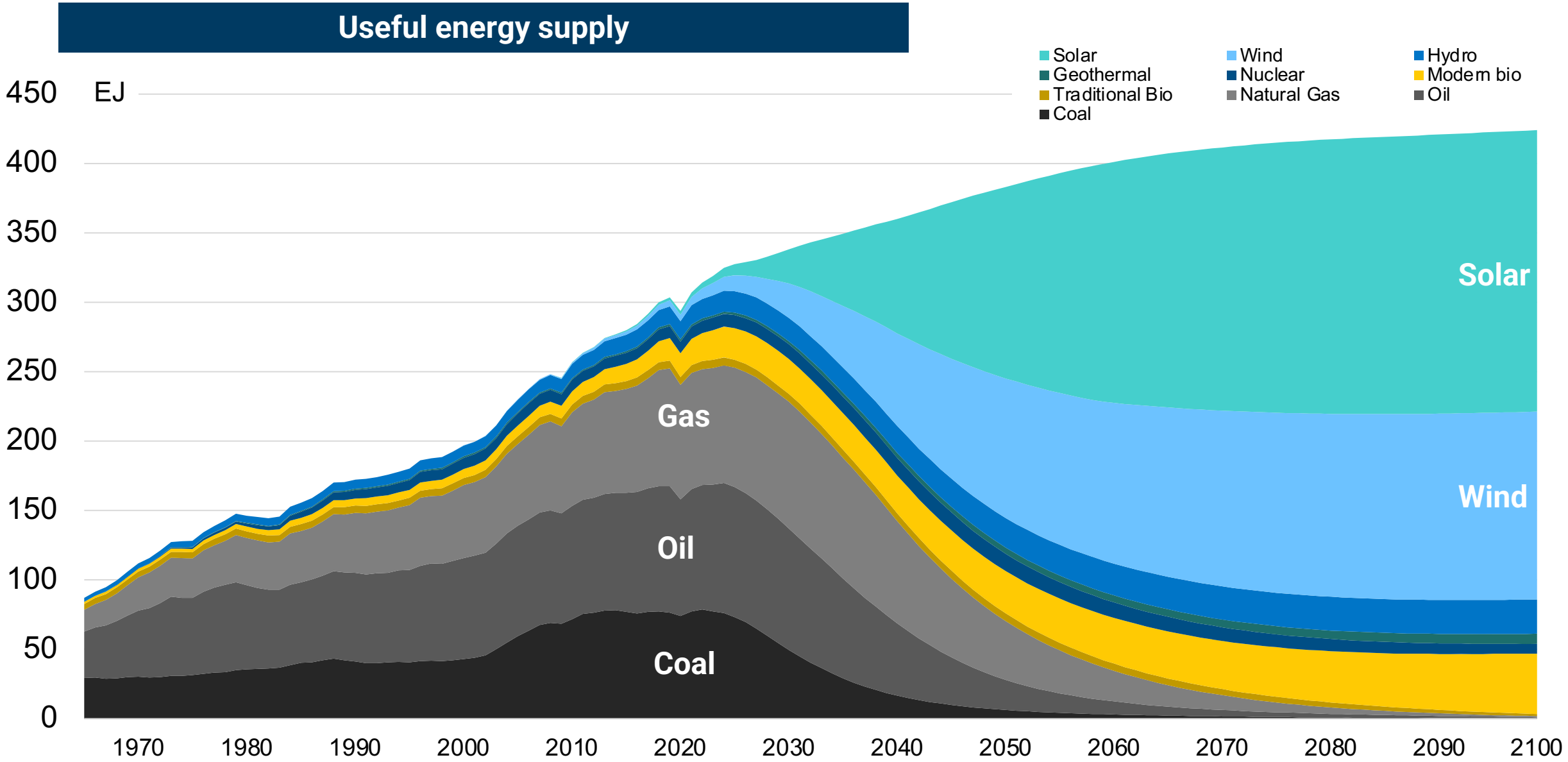

**Source:** BP, Ember

# And will reshape the energy system




**Source**: RMI based on 2022 data from BNEF, Tesla framing

# So this is where we are heading



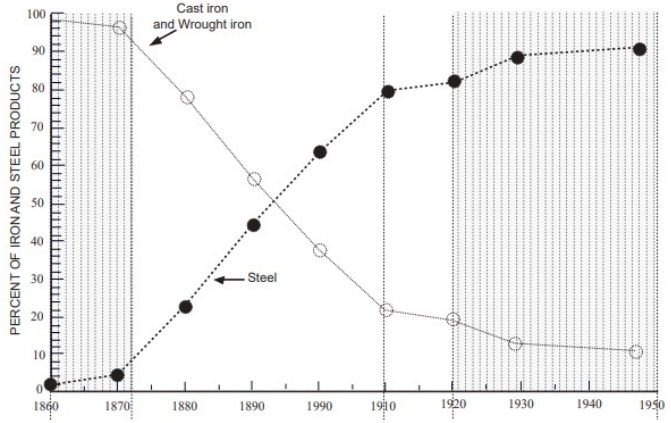



**Source:** Rystad central scenario

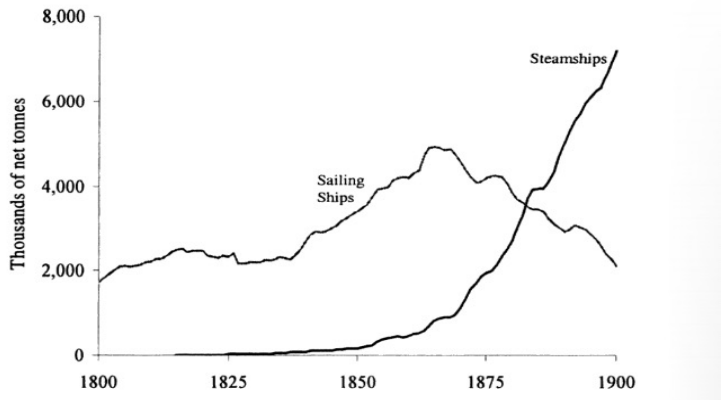
# A technology shift we have seen many times before

The risk is to be left high and dry with old technologies. Greenwashing and CCS are tactics not strategy

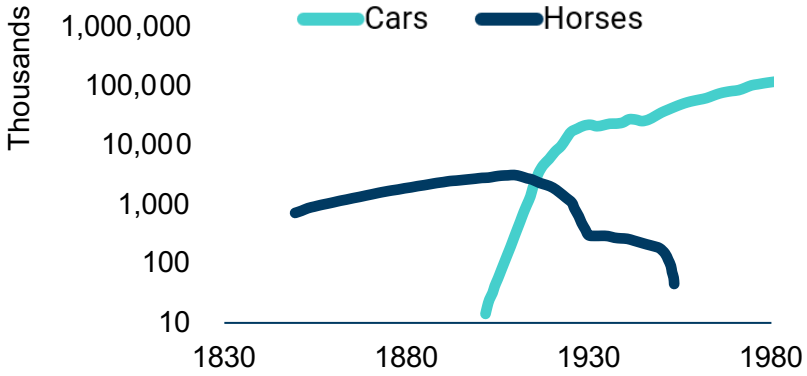
### Cast iron to steel



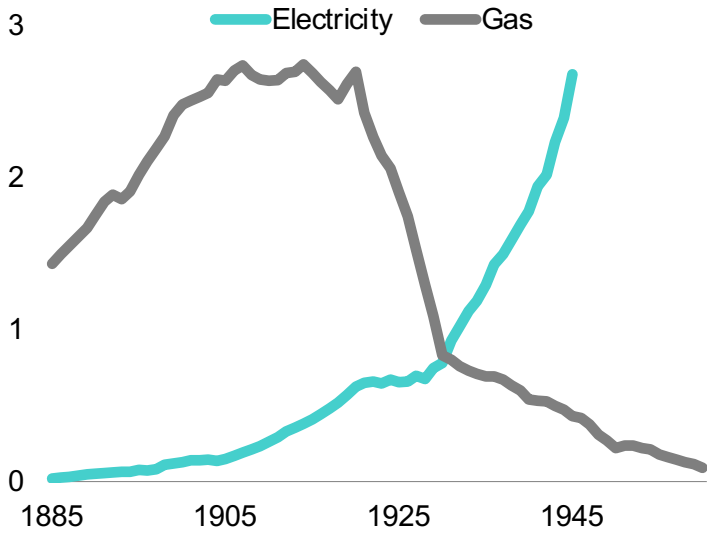

### Transport: Sailing ships to steamships



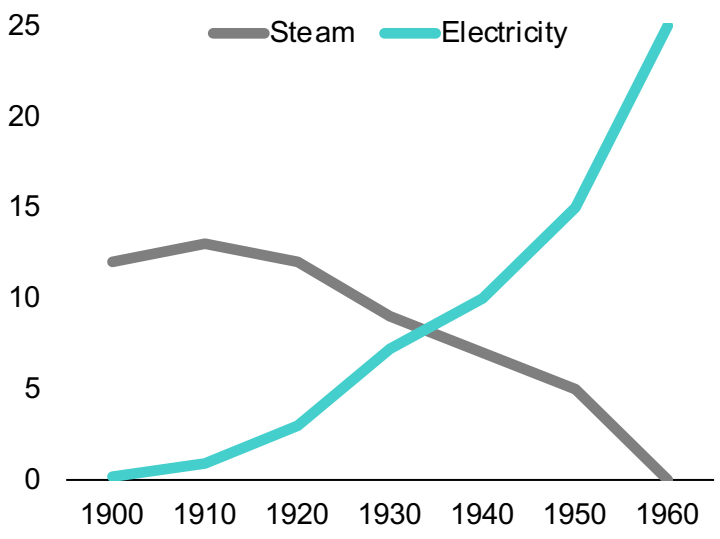

### Transport: Horses to cars



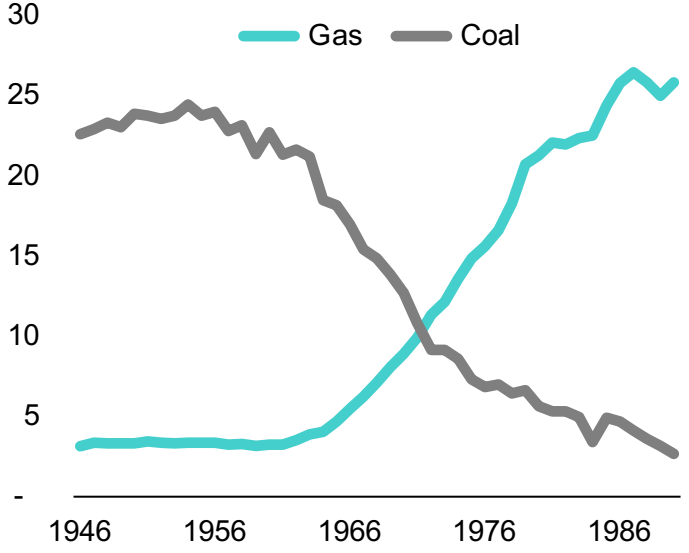

### Lighting: Gas to electricity




### Power: Steam to electricity



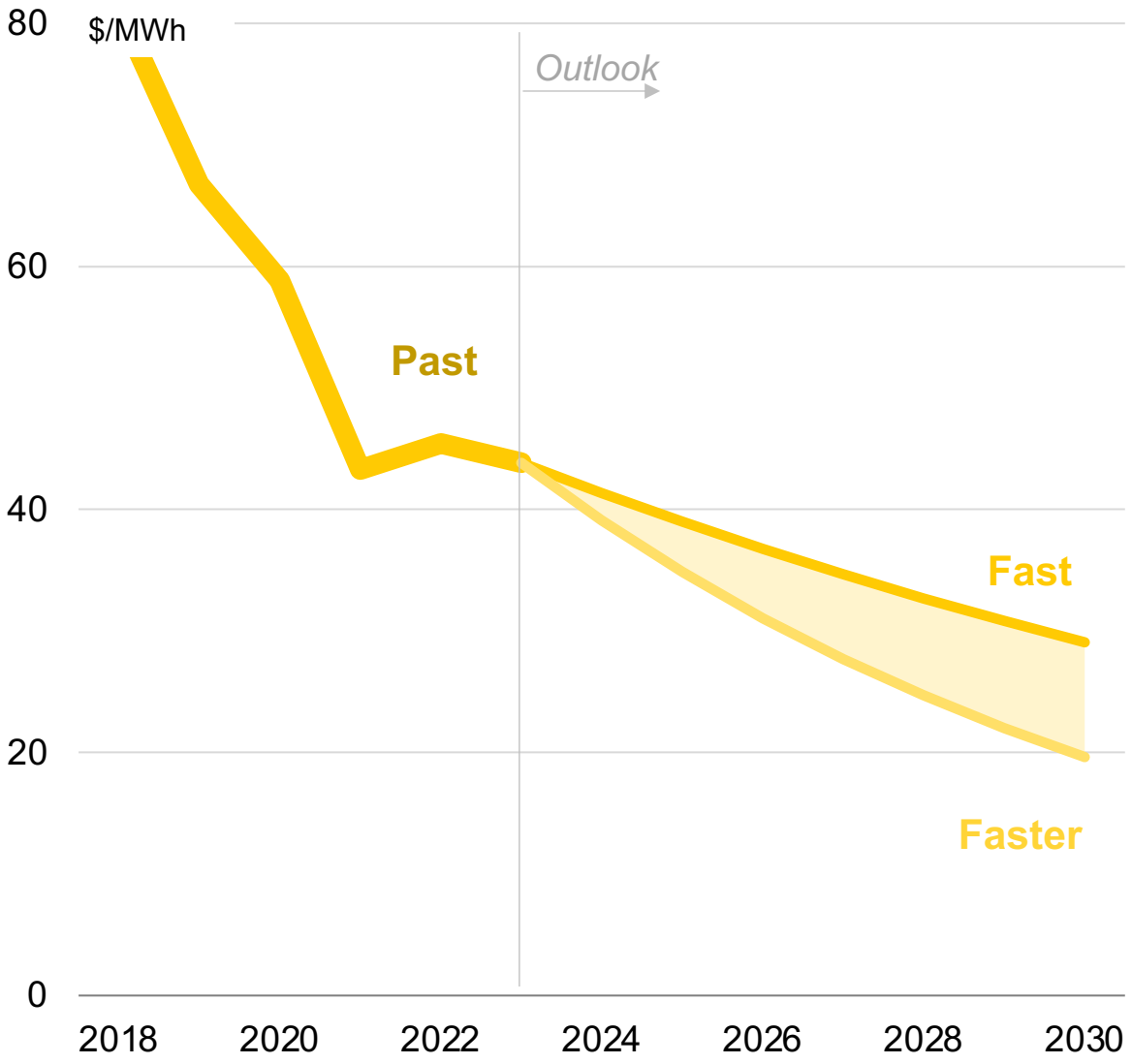

### Heat: Coal to gas



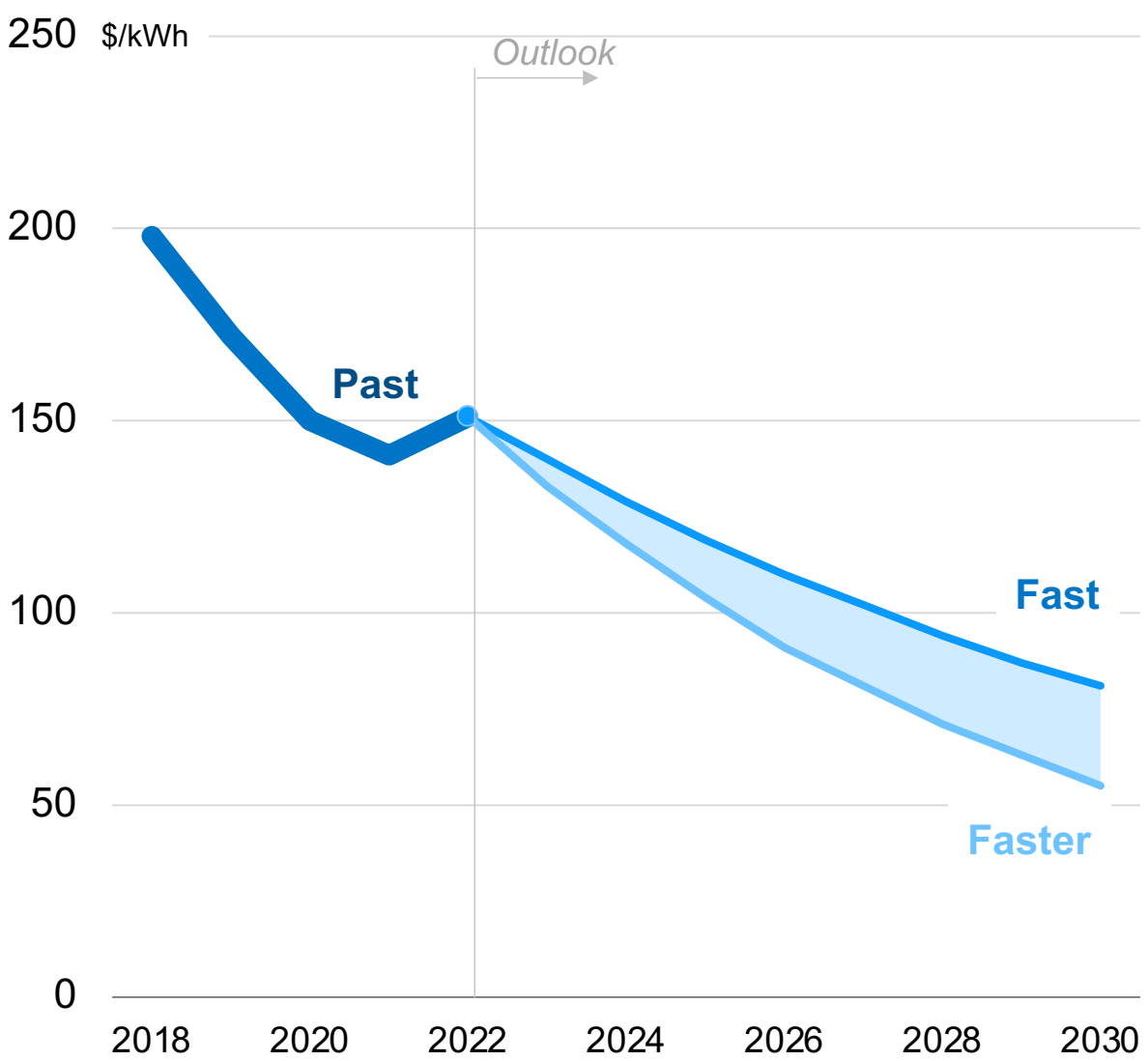

**Source:** Perez, Fouquet, Nakicenovic, Mitchell; Note: all UK charts except horses to cars (US)

# Why we can be confident of success? Costs are falling

## Solar costs

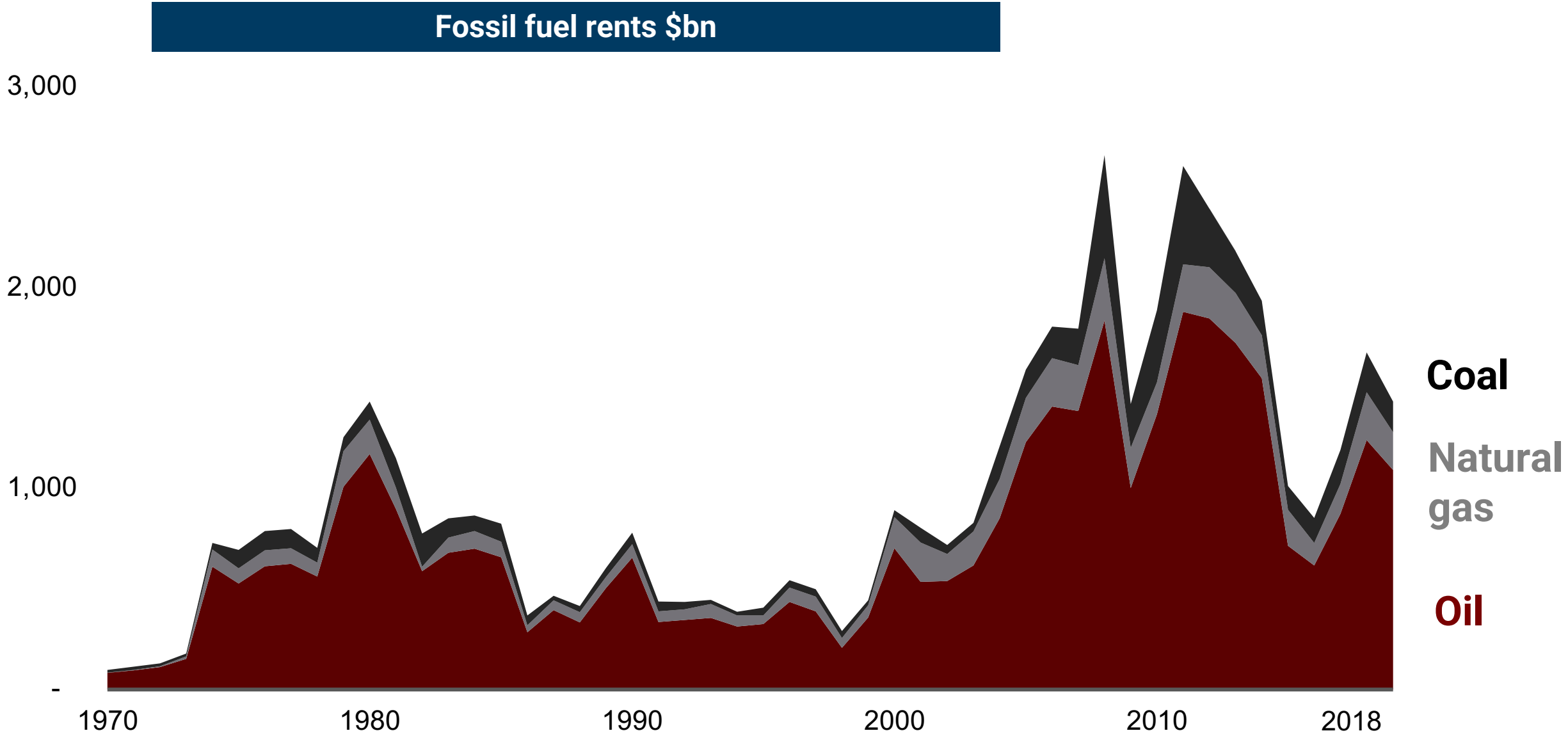



## Battery costs




**Source:** BNEF, RMI

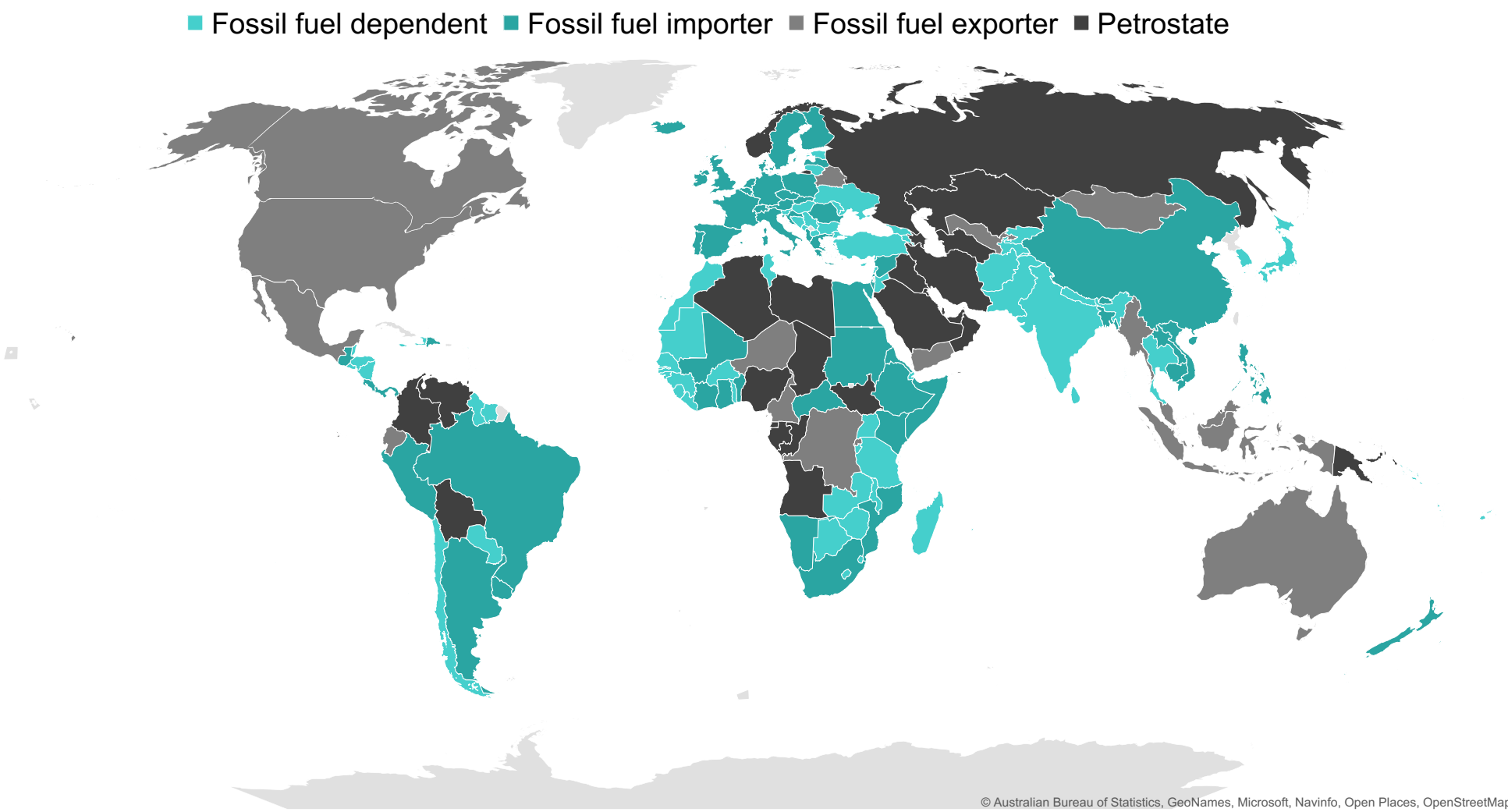
# The opportunity is huge




**Source**: World Bank

# Renewables provide energy security

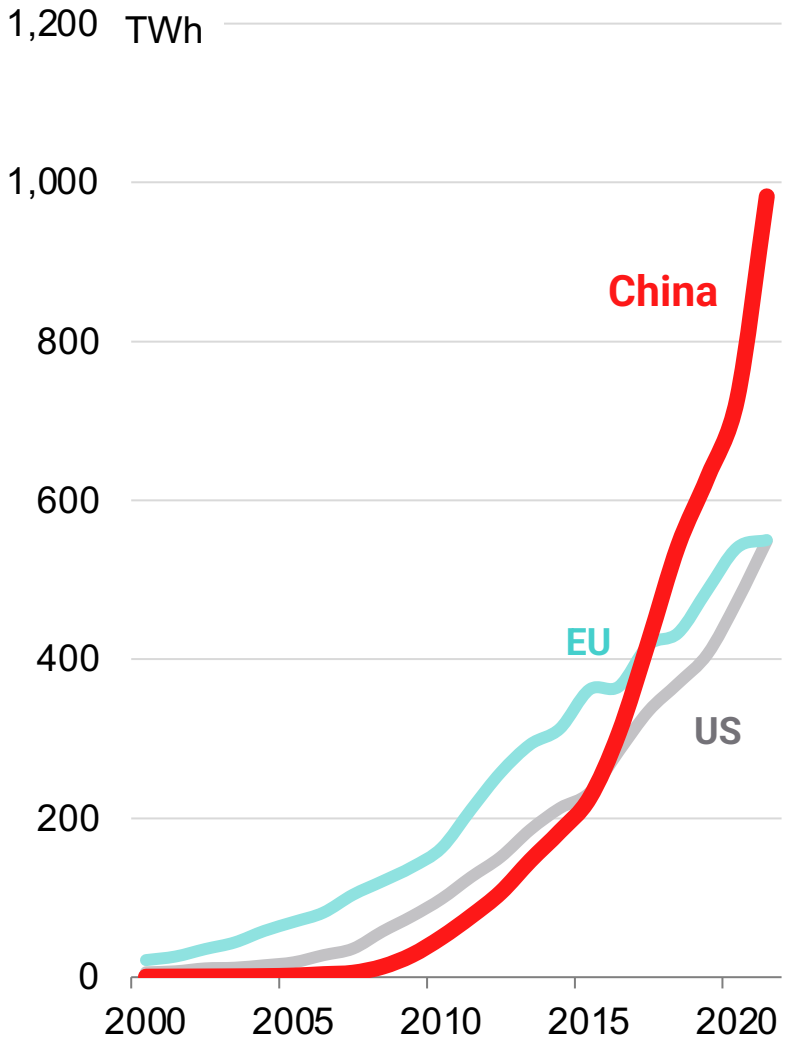
## Importers and exporters



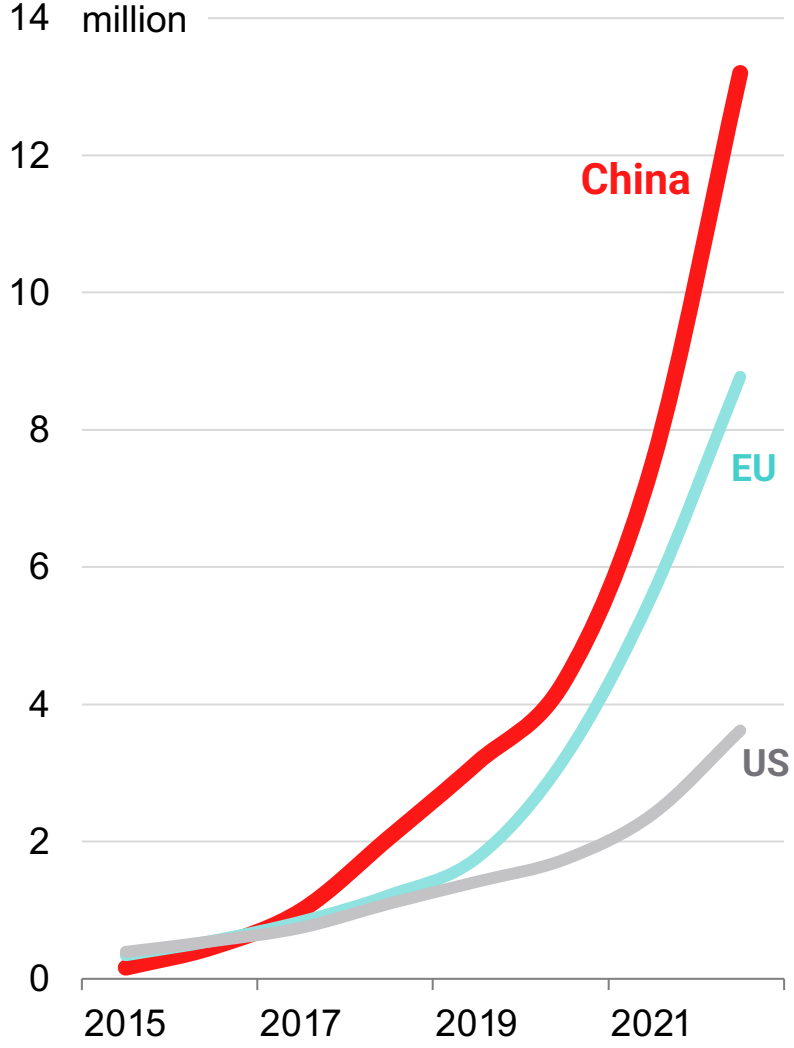

**Source:** World Bank

# There is a race for the top

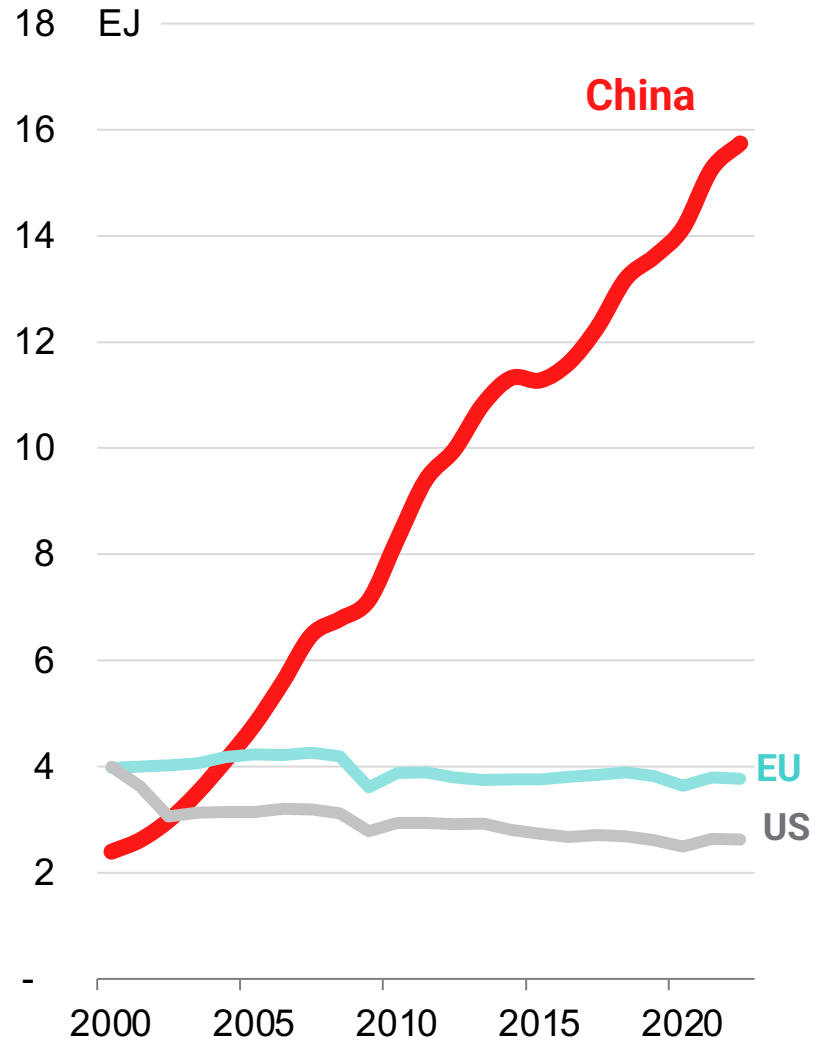
## Solar and wind generation




## Electric vehicle car fleet




## Electricity demand in industry

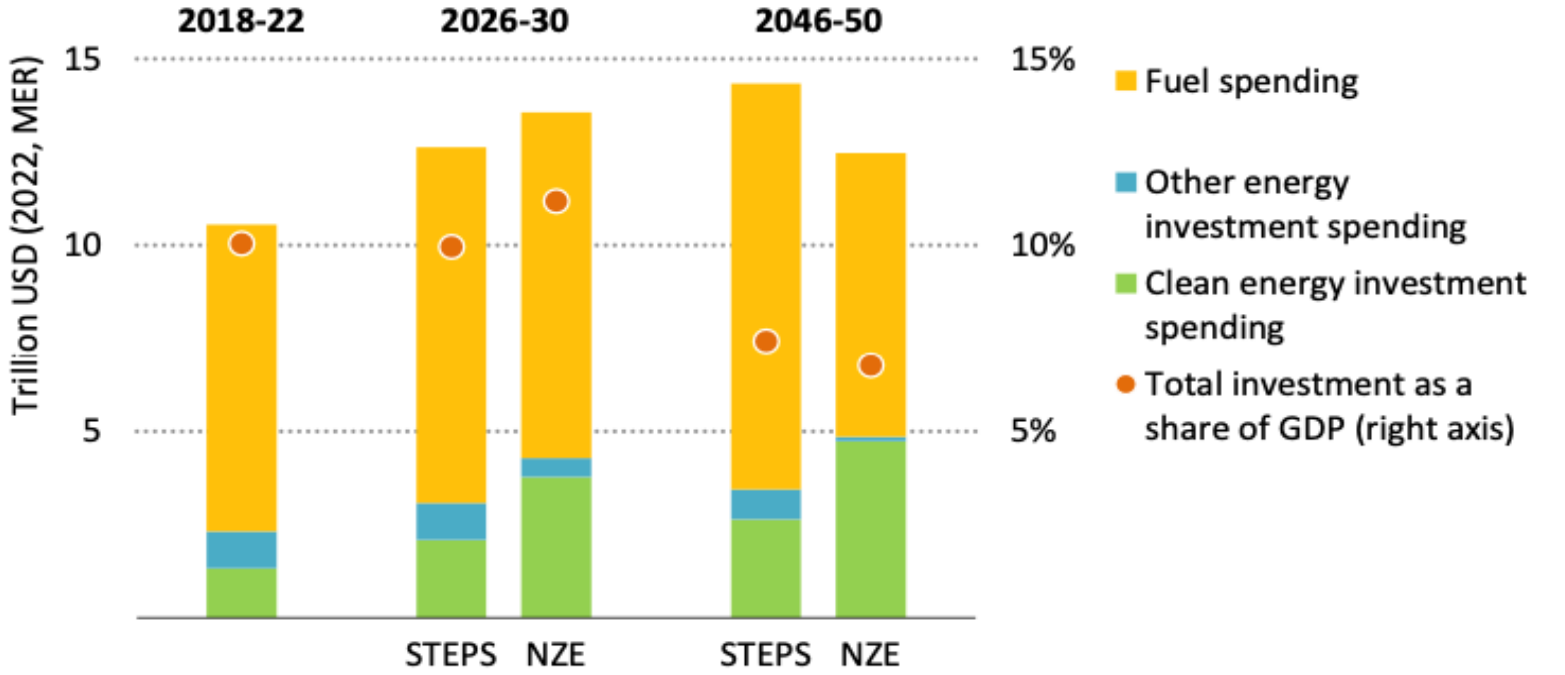



Source: BP, BNEF

# A renewable system is cheaper

## Capital expenditure and fuel costs in the net zero scenario

**Figure 4.14** ▷ Global energy investment and spending on fuels in the STEPS and the NZE Scenario, 2018-2050

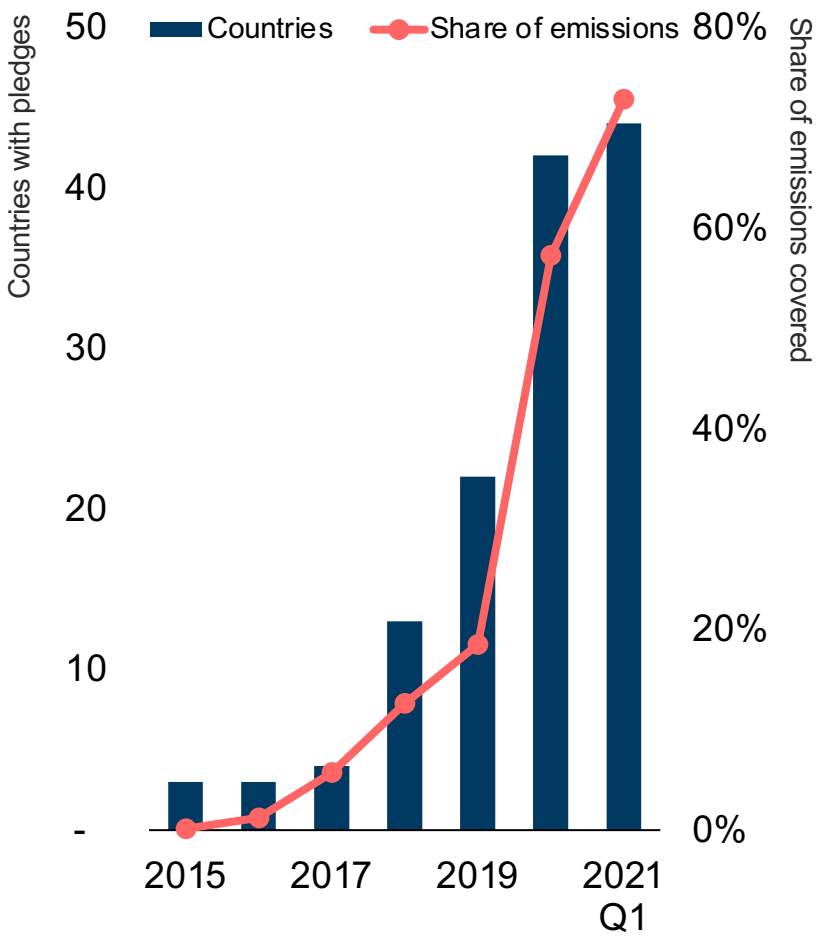





**Source**: IEA NZE 2023

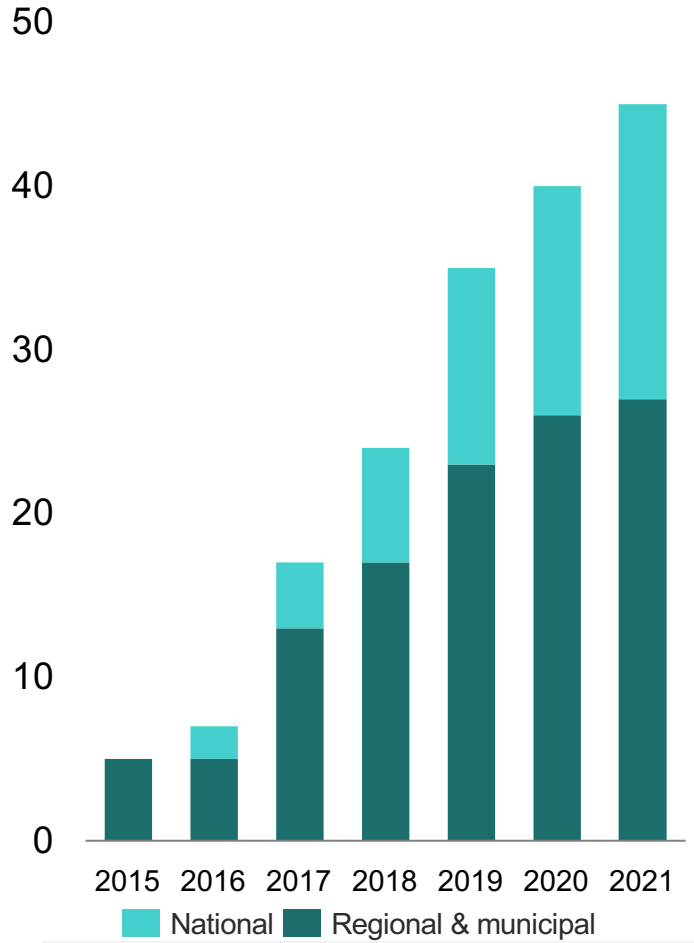
# So policy action will keep rising

## Net-zero targets



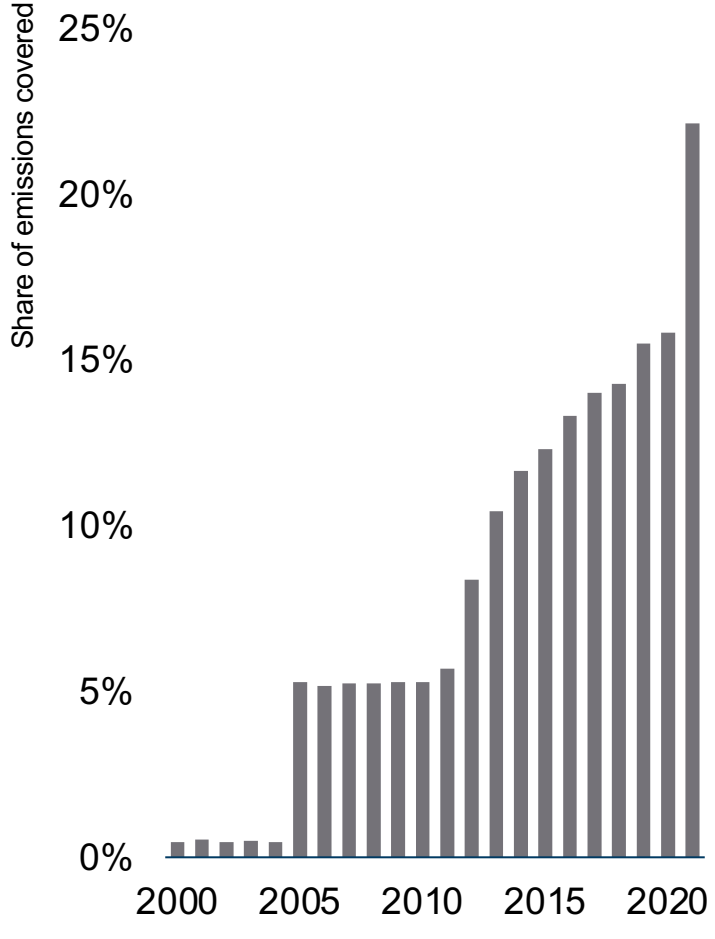

In 2022, over 90% of the world by GDP had set net-zero targets, up from 6% in 2017.

## # Combustion car bans




Fifty countries and regions are planning to ban ICE cars.

## Carbon taxes




The share of emissions covered by taxes has increased fourfold in a decade.

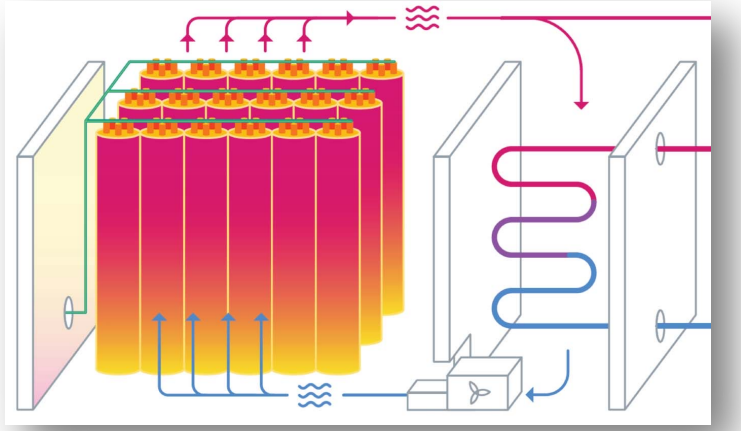
**Source:** IEA, BNEF, World Bank

# Innovation will continue to pour into the space

## Hyke's electric ferry

## Zeroavia H2-electric aviation


## Rondo's industrial heat battery

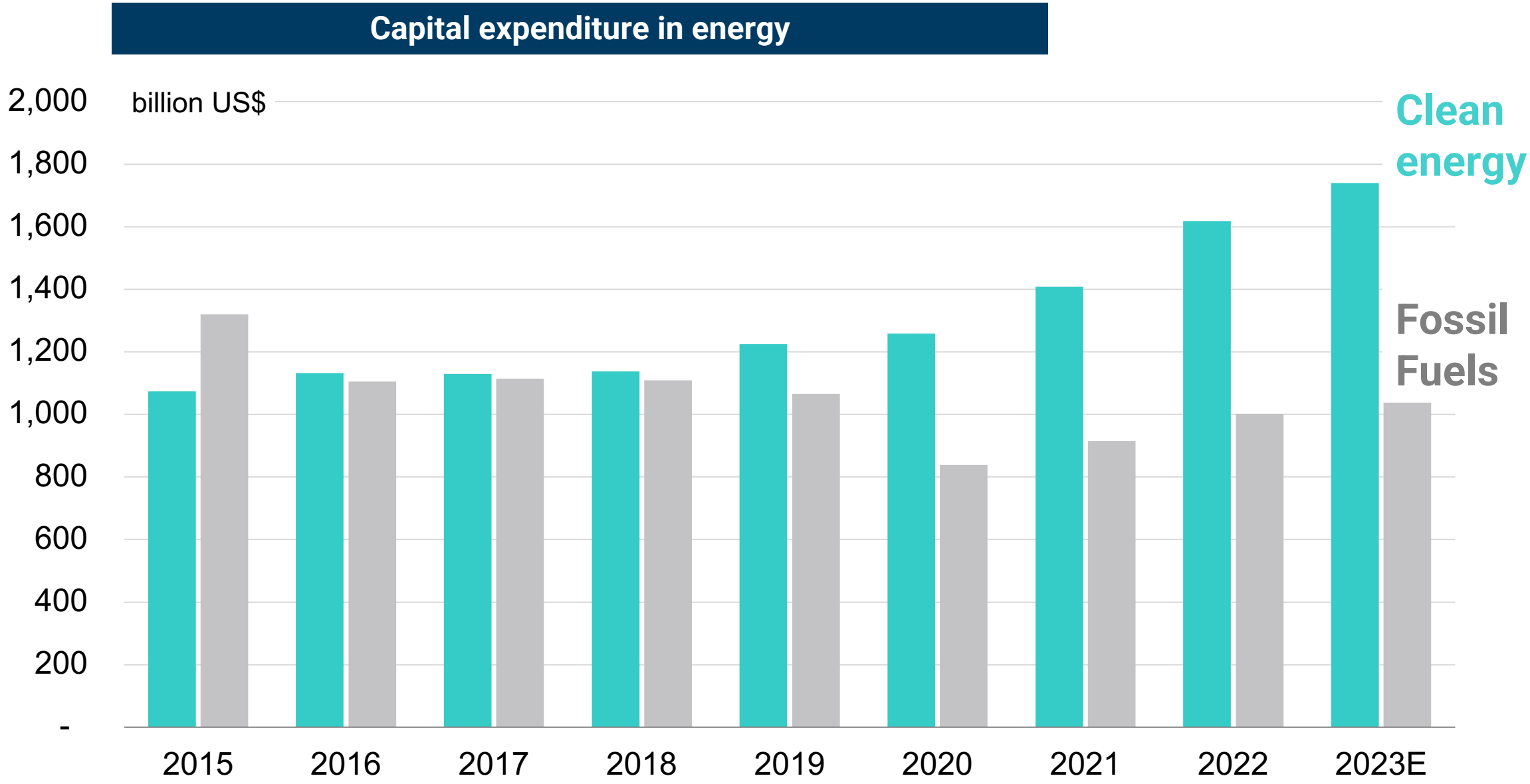


## Siemens' industrial heat pump




**Source:** Hyke, Zeroavia, Rondo, Siemens

# Capital is moving

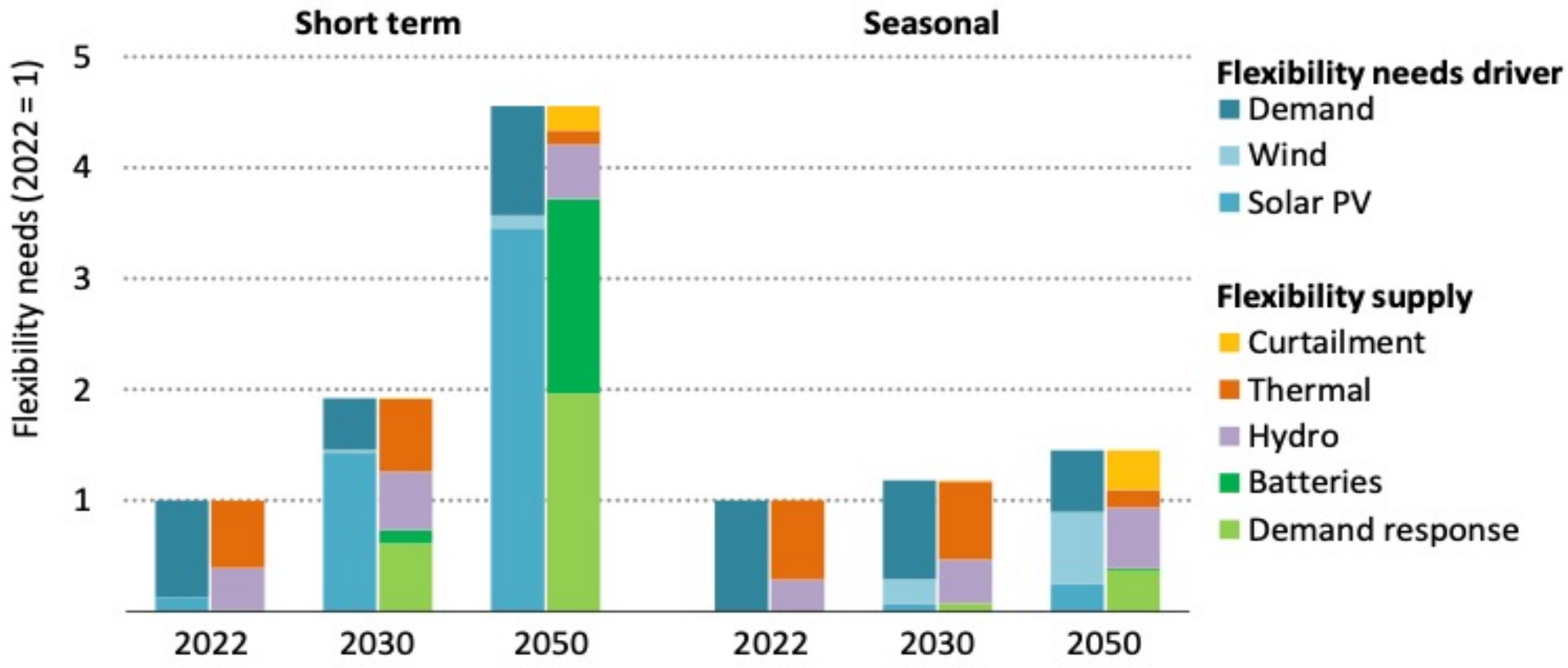



**Source**: IEA World Energy Investment 2023

# The challenges are many but the solutions are more

## Flexibility provision

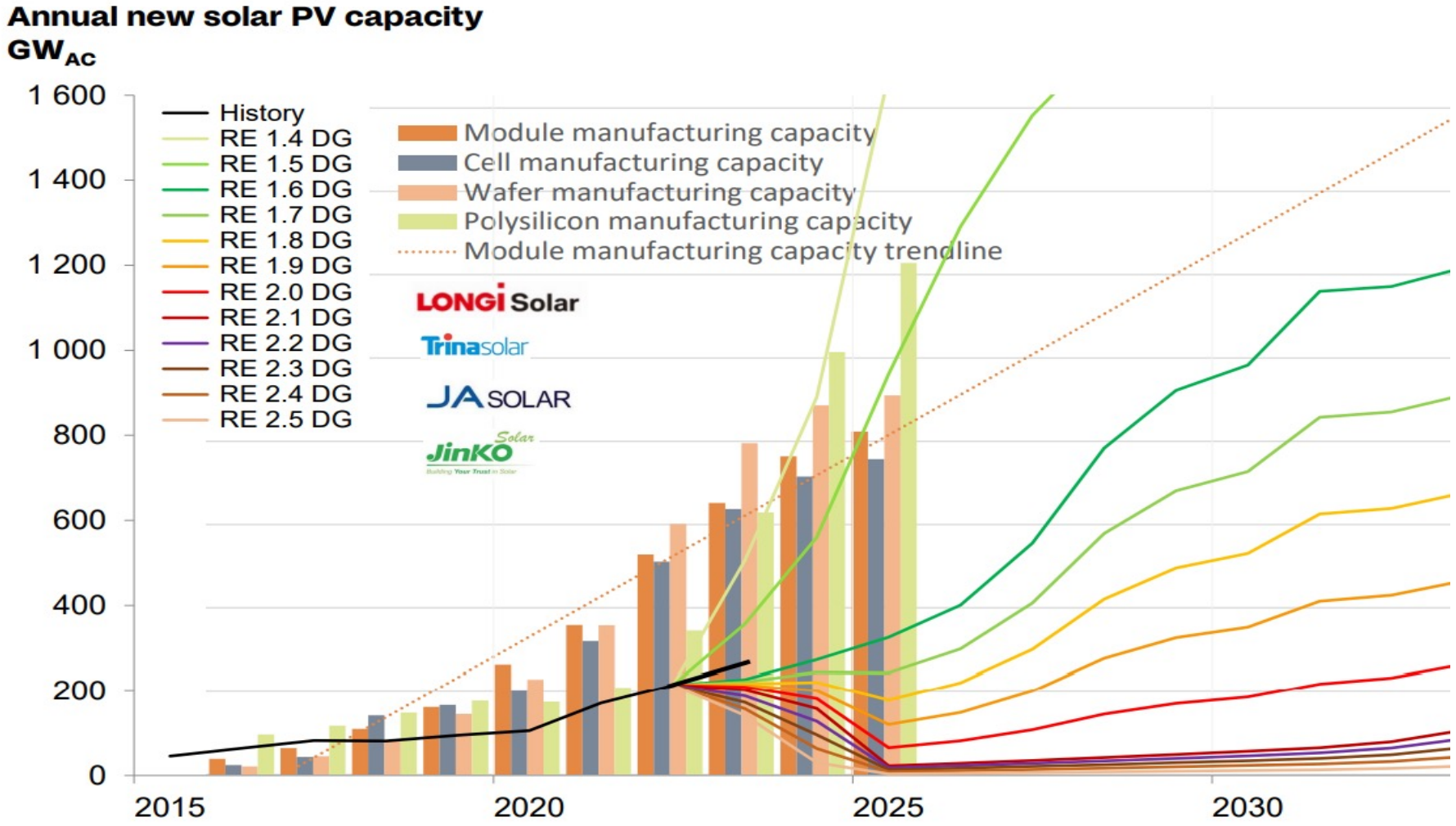
**Figure 4.13** ▷ Global power system flexibility needs and supply in the APS




Source: IEA WEO 2023

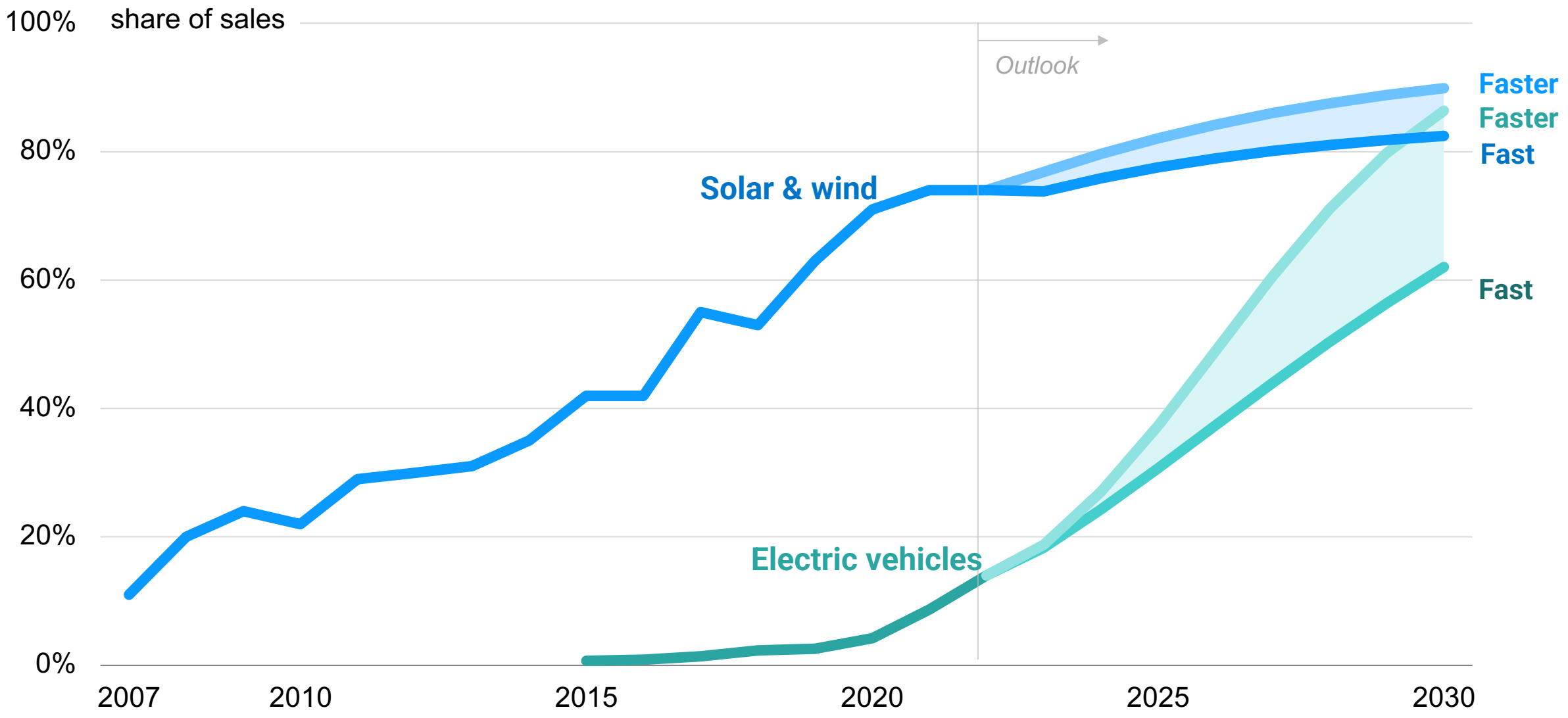
# What is special about this decade: capacity gets built

## New solar capacity




Source: Rystad

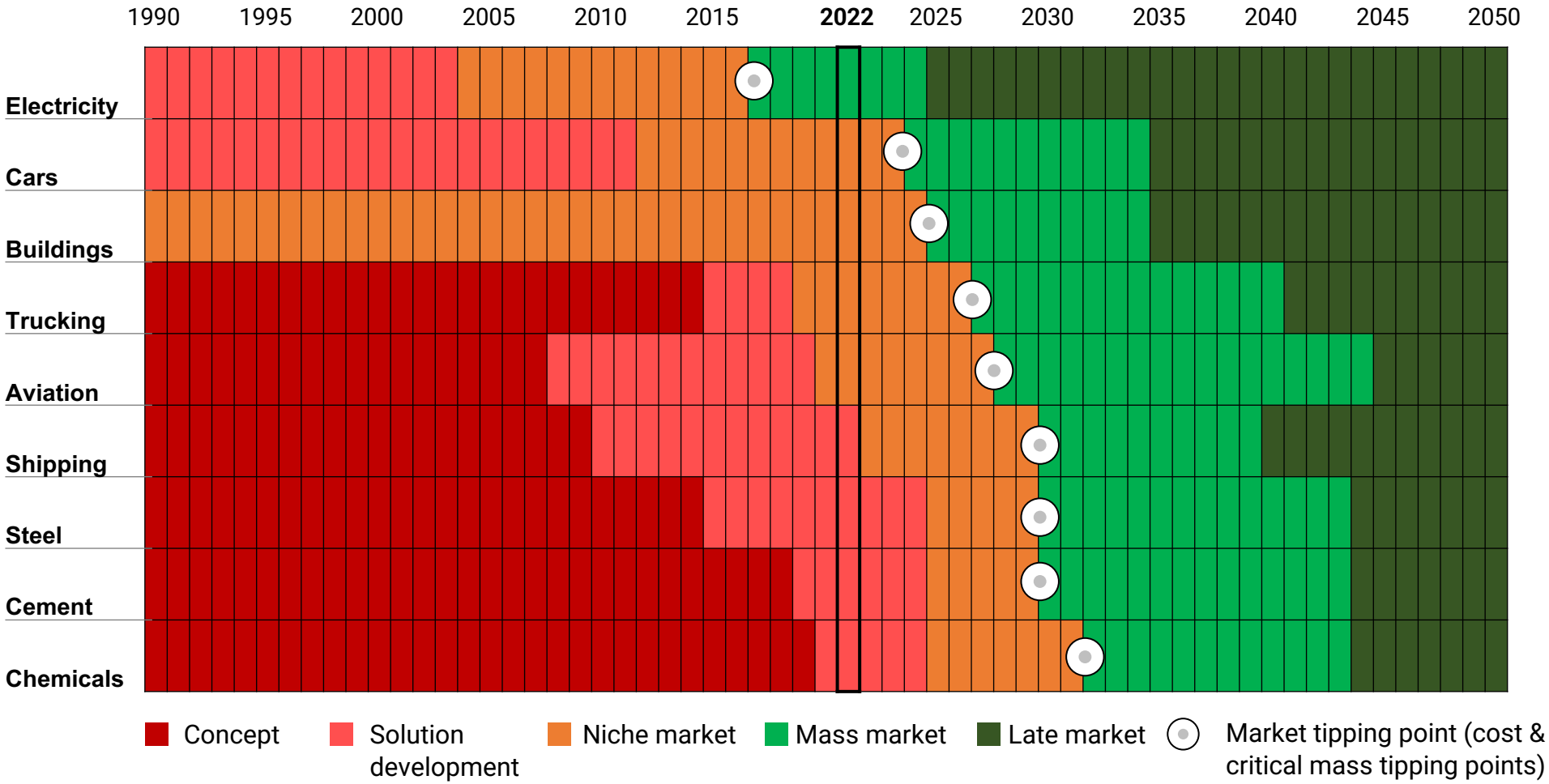
# Renewables race up S-curves






**Source**: BNEF & IEA (past), RMI (forward). Note: Solar & wind share of gross additions in GW

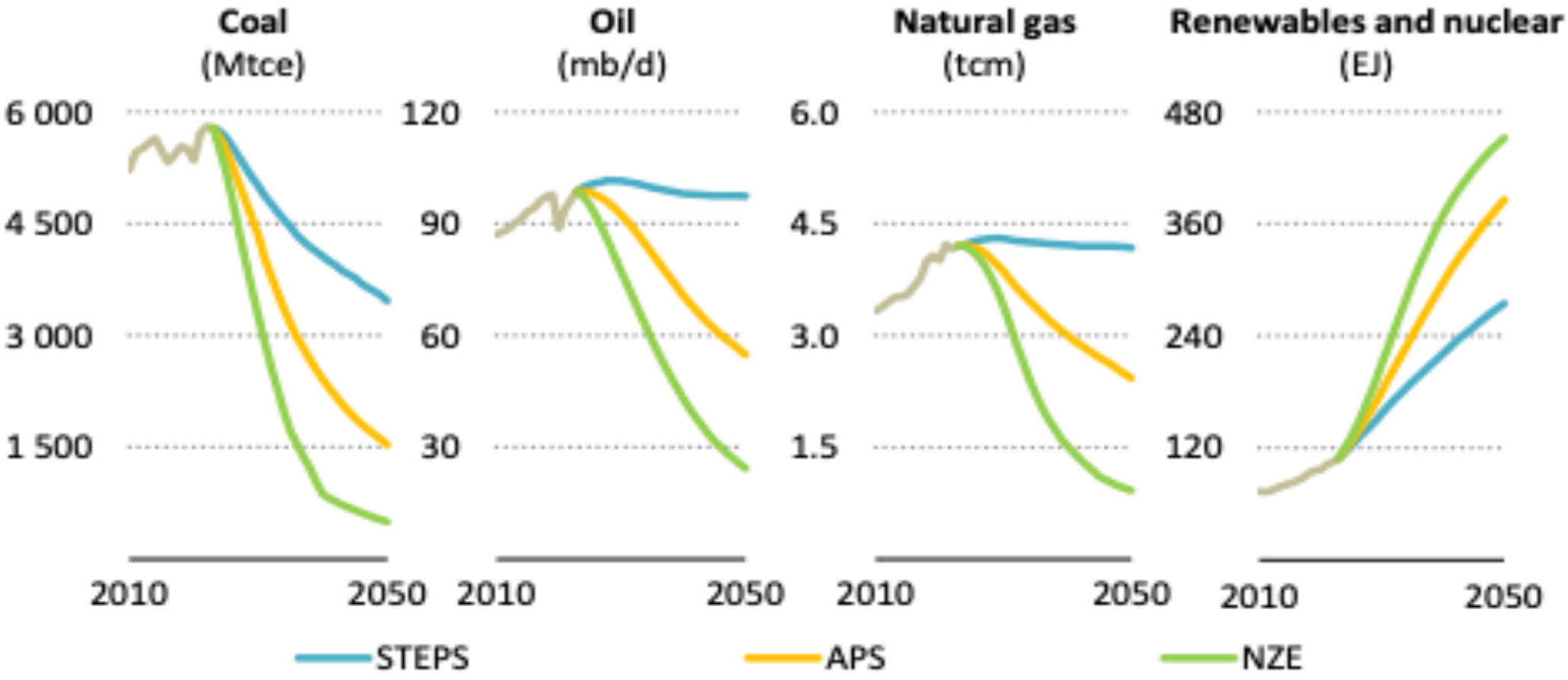
# Key Sectors Hit Their Tipping Point




**Source**: SYSTEMIQ

# Fossil fuel demand faces decline or collapse

## Energy demand






Source: IEA WEO 2023

# The debate will be very different in 2030

- If we ensure that renewable growth stays on track, both reality and perception will be very different in 2030.
- Renewable costs will be clearly lower than fossil costs in at least one part of every major system.
- Societal pressure for change will be higher.
- Renewables will be supplying all the growth in energy demand, and fossil fuel demand will be in clear decline.
- Many barriers to change will be solved, and new solutions will be visible.
- Geopolitics and financial markets will have embraced the new technology.

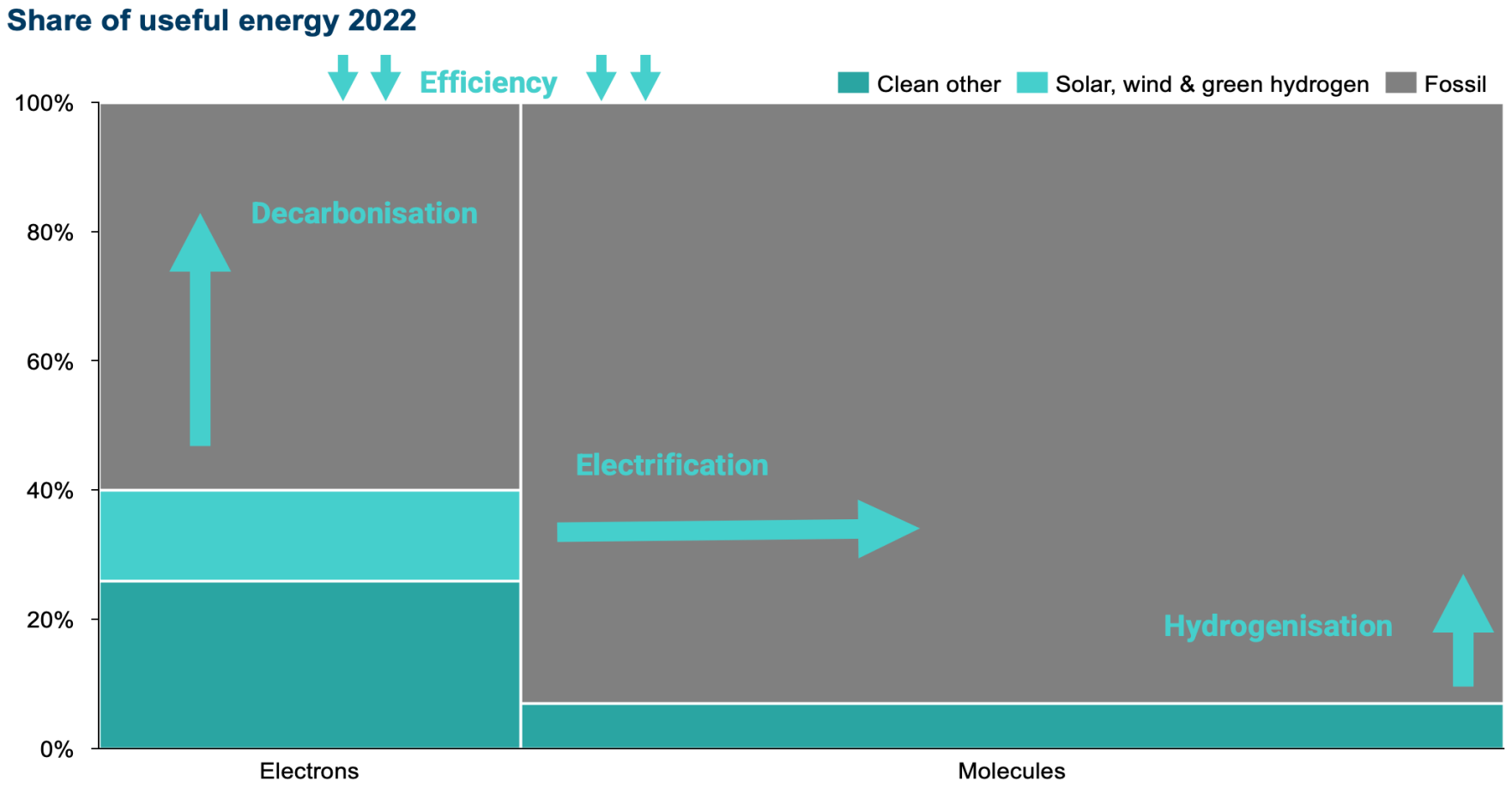
**A change in both reality and perception**

| Area | 2023 | 2030 |
|---|---|---|
| Relative costs renewables vs. fossil fuels | Comparable | Renewables are much cheaper |
| Societal pressure for change | Moderate | Intense |
| Renewable share of energy demand growth | Most of the growth | All of the growth |
| Share of solar & wind in electricity generation | About 14% | About 40% |
| EV share of sales | About 20% | Over 70% |
| Global fossil fuel demand | Maybe peaking | Clearly in decline |
| China's fossil fuel demand | Maybe peaking | Clearly peaked |
| Harder-to-solve sectors | Some solutions | Lots of solutions |
| Barriers to change | Lots of concerns | Less concerns |
| Geopolitics | Renewables nice to have | Renewables a key tool of power |
| Financial markets | I should hedge my bets | Renewables are the future |
| Corporations | Green premium | Green prize |

**Source:** RMI

# What we need to do: The 4 key levers

## The four key drivers of change

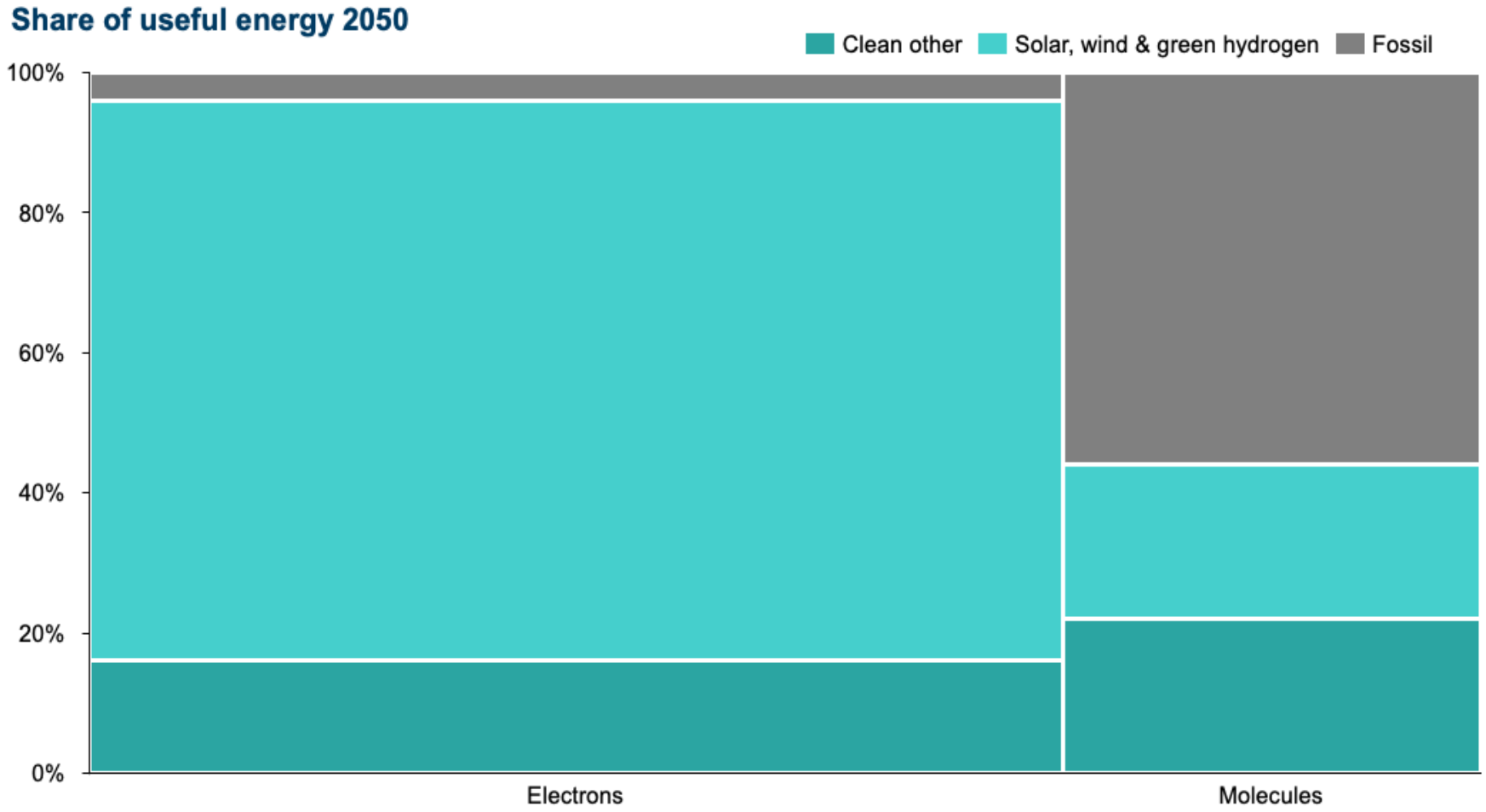





Source: IEA WEO 2023

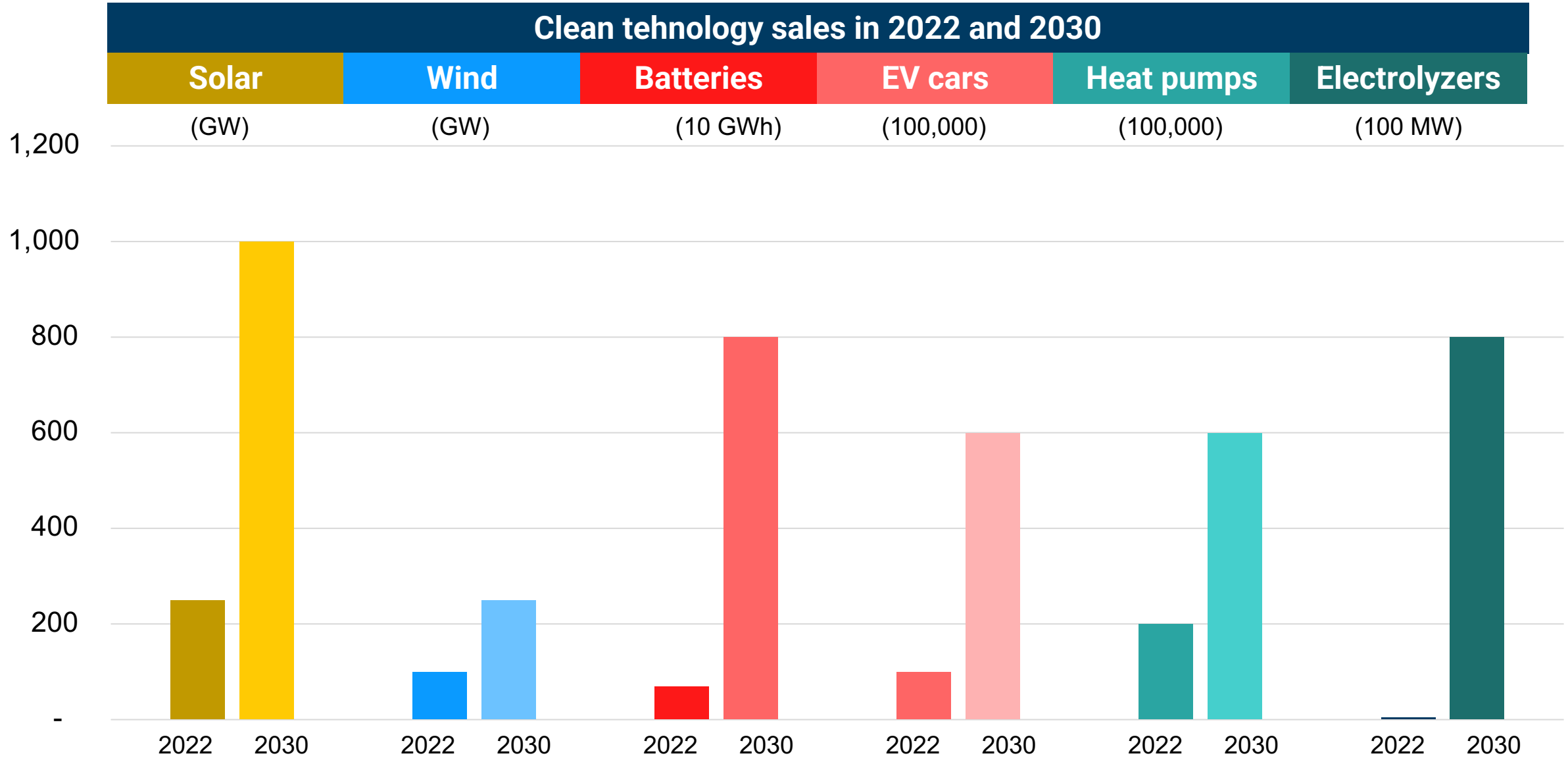
# Avoid temporary solutions

## Useful energy supply in 2050




Source: Rystad, RMI

# Build out the new






**Source**: RMI, Rystad

# Investors: play the renewable supercycle

The energy transition is a megatheme, like the industrialization of China or the growth of the internet. The investment response is clear:

**Allocate capital to growth sectors**

**Exit sectors in decline. Or trade the volatility on the way down**

**Go long-short winners and losers from change. Disruption is coming so separate reality from lip service**

**Pick winners. The Gartner hype curve is the standard tool**



**Source:** RMI

## About RMI

RMI is an independent nonprofit founded in 1982 that transforms global energy systems through market-driven solutions to align with a 1.5°C future and secure a clean, prosperous, zero-carbon future for all. We work in the world's most critical geographies and engage businesses, policymakers, communities, and NGOs to identify and scale energy system interventions that will cut greenhouse gas emissions at least 50 percent by 2030. RMI has offices in Basalt and Boulder, Colorado; New York City; Oakland, California; Washington, D.C.; and Beijing.

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With special thanks to: Lena Hansen, Rushad Nanavatty, Laurens Speelman, and Daan Walters

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